



## Standard Guide for Remedying Structural Silicone Glazing<sup>1</sup>

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### 1. Scope

1.1 This guide provides recommendations for remedying existing structural sealant glazing (hereinafter called SSG) installations in situ. Remedial work may be necessary when a lite of glass is replaced, for routine maintenance, or after distress is discovered. This guide focuses on large-scale remedies.

1.2 Committee C24 is not aware of any comparable standards published by other organizations.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

C 717 Terminology for Building Seals and Sealants<sup>2</sup>

C 1392 Guide for Evaluating Failure of Structural Sealant Glazing<sup>2</sup>

C 1394 Guide for In-Situ Structural Silicone Glazing Evaluation<sup>2</sup>

C 1401 Guide for Structural Sealant Glazing<sup>2</sup>

E 330 Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference<sup>3</sup>

E 997 Test Method for Structural Performance of Glass in Exterior Windows, Curtain Walls, and Doors Under the Influence of Uniform Static Loads by Destructive Method<sup>3</sup>

E 1233 Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential<sup>3</sup>

### 3. Terminology

3.1 *Definitions*—Definitions of the terms used in this guide are found in Terminology C 717.

#### 3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *distress, n*—the individual or collective physical manifestations of a failure as perceivable problems. For structural sealant glazing, such distress may include sealant adhesive failure, sealant cohesive failure, shifting of a lite, loss of a lite, or water infiltration (see Guide C 1394).

3.2.2 *qualified person, n*—one with a recognized degree or professional registration and extensive knowledge and experi-

ence in the field of structural sealant glazing, and who is capable of design, analysis, and evaluation in the subject.

### 4. Significance and Use

4.1 Guidelines are provided for remedying existing SSG installations. Refer to Guide C 1401 for a complete discussion of proper SSG design, installation, and materials.

4.2 Due to the unlimited range of materials that may be used in a particular building, and because each design is unique, the information contained in this guide is general in nature.

4.3 This guide should not be the only reference consulted when designing remedies for SSG. For example, the local building code and the manufacturers' product literature for the actual materials used, if known, also should be considered. The sealant manufacturer(s) should be involved fully with the remedial design.

4.4 This guide is intended to be a resource, but it is not a substitute for experience and judgement in designing remedies for the specialized types of construction discussed. It is intended to be used in conjunction with other resources as an aid in remedying problems with existing SSG.

### 5. Introduction

5.1 There are numerous reasons that a building owner or manager, hereinafter referred to as owner, may choose to remedy an SSG system, including routine maintenance or to correct discovered deficiencies. Regardless of the reason that such a remedy is undertaken, it is recommended that the remedial design and construction be performed under the supervision of a qualified person.

5.2 It is essential to begin the remedial process with a comprehensive evaluation, in accordance with the guidelines established in Guide C 1394. The underlying cause of failure must be understood fully prior to implementing a remedy; otherwise, the failure may be repeated.

5.3 Based on the outcome of the evaluation, various remedies may be indicated. The potential remedies include, depending on the pervasiveness and the nature of the problem, the following:

5.3.1 Minor, isolated repairs, such as the replacement of an individual lite of glass, can be performed by a competent glazier trained in the proper installation of SSG. If the original SSG was properly done, then such minor repairs can be performed simply by duplicating the original procedures.

5.3.2 In-situ remedial work is necessary where pervasive

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.07.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.11.

problems exist in an SSG application, such as due to poor design or workmanship during original construction.

5.3.3 Complete reglazing may be necessary in extreme cases or at the end of the useful service life, in accordance with the principles for new SSG. For example, if the existing joint configuration does not allow adequate cleaning to replace a structural joint, it may be necessary to reglaze, because adhesion is critical to the performance of SSG and cleaning is critical to adhesion.

5.4 The remainder of this guide particularly addresses the type of in-situ remedial SSG projects as described in 5.3.2, to correct a pervasive problem without comprehensive reglazing.

## 6. Remedial Design

6.1 If it is determined that a large-scale remedial program is necessary, then a remedial design should be developed by a qualified person.

6.2 Depending on the cause of the problem(s) with the existing installation, it may not be prudent to rely on the original SSG design.

6.3 The remedial design should include the following:

6.3.1 Calculations of the structural sealant stress so that the final installation will comply with the SSG industry guidelines (see Guide C 1401) and applicable codes. In some jurisdictions, glass replacement triggers the requirement to comply with the current building code for glass strength and structural sealant joint capacity, rather than the code under which the building was originally constructed.

6.3.2 Sealant product selection to be compatible with all existing materials that it will contact.

6.3.3 Accessory product selection, if any are replaced or added by the remedy, to be compatible with all existing materials that they will contact.

## 7. Field Testing

7.1 Prior to implementing the proposed remedial work, field testing should be performed under the direction of a qualified person. Whereas, in new SSG installations it is possible to perform laboratory testing to verify the adhesion characteristics of the products and substrates, remedial SSG usually requires field testing. In-situ adhesion testing is strongly recommended for the selected product combination, including cleaner, primer, sealant, and the actual adhesion surface of the substrate.

7.2 Field testing of the actual adhesion surface of the substrate is recommended, rather than another face of the same component, because the adhesion characteristics may vary with exposure. It may be necessary to deglaze a lite to access the actual adhesion surface. It is not recommended to test faces of components other than those actually scheduled for permanent adhesion because the adhesion characteristics can vary with exposure and manufacturing processes.

7.3 Because the field test procedure may be cumbersome and expensive to perform, it is recommended to perform pretesting to screen possible combinations of products. These preliminary tests may be performed in the laboratory or in the field on convenient surfaces of the components, rather than the actual adhesion surfaces.

7.4 To verify adhesion with the final product combination,

one field test procedure is as follows:

7.4.1 Perform a minimum of three tests in selected mock-up areas. More tests should be performed depending on the reasons for repair, or if the existing conditions vary with exposure or other variables.

7.4.2 Apply structural sealant and accessories to actual adhesion surfaces exactly as they are intended to be installed during full-scale production work.

7.4.3 Adjust the installation so that the structural sealant is exposed, for example, a weatherseal joint may have to be omitted during testing.

7.4.4 After the cure time recommended by the sealant manufacturer, install chambers over the test joints and adjacent substrates. Bed chambers in sealant and adhere to the face of the metal and glass, leaving the top open for filling. See Fig. 1.

7.4.5 Fill the chambers with distilled water, causing the face of the test joints to be completely immersed in water. Seal the top edge of the chambers after filling, to prevent evaporation. In cold climates, consideration should be given to protecting the chamber from freezing.

7.4.6 After seven days water immersion, remove chambers and perform adhesion tests as prescribed by the sealant manufacturer. Acceptance criteria should be determined by the sealant manufacturer.

7.5 Finally, prior to proceeding with implementation of the remedial work, consideration should be given to performing a full-scale load test on representative mock-ups. These tests can be performed using suction cups on the exterior or interior of the glass (Guide C 1392) or pressurized chambers on the interior or exterior (Test Methods E 330, E 997, or E 1233). Such tests are often conducted at 1.5 times the design wind service load. Depending on the specific causes of failure identified by evaluation (Guide C 1394), it may be appropriate to test individual components at different test loads.

## 8. Remedial Work

8.1 Once a remedial program has been developed and tested, it is essential that the production work be implemented exactly like the approved mock-ups.

8.2 It is important to recognize that most new SSG is performed using shop-glazing methods, whereas remedial SSG typically will require field-glazing. It is more difficult to maintain quality control procedures in the field, extra attention should be paid to monitoring the implementation, particularly to ensure complete joint filling. Additional field testing also is warranted. It is recommended that this monitoring and testing be performed by or under the direction of a qualified person.

8.3 Even if it is generally expected that the specified remedial work will be practical at most locations, it is prudent to inspect each lite of glass and its opening before implementing the remedy for differing existing conditions, such as localized defects or dimensional variations. In particular, each crew should have a measuring device (check block) of fixed size to determine whether the joint width is at least the minimum specified before sealing; commonly, such devices are fabricated for the project from wood, metal, or plastic. If the device does not easily fit into a joint along any 6 in. (or other dimension specified) of joint length, then it should be reglazed in full compliance with the standards for new SSG.

## BIBLIOGRAPHY

### *Documents Prepared by Manufacturers and Trade Associations:*

- (1) *Structural Silicone Glazing*, by Dow Corning Corporation
  - (2) *Structural Silicone Glazing Guide*, by General Electric (GE Silicones) Company
  - (3) *Architectural Guidelines for Glazing Systems*, by Tremco Corporation
  - (4) Curtain Wall Manual No. 13, *Structural Sealant Glazing Systems (CW-13)*, AAMA
  - (5) *Two-Sided Structural Glazing Guidelines for Aluminum Framed Skylights, Item No. AAMA TSGG-91*, AAMA
- Books:*
- (6) Klosowski, J.M. *Sealants in Construction*, Marcel Dekker, Inc., 1989.
  - (7) Panek, J. R. and J.P. Cook, *Construction Sealants and Adhesives*, John Wiley & Sons, 1984.
- Technical Papers and Special Technical Publications:*
- (8) Wilson, M.D., "In-Situ Re-Glazing of Structural Sealant Glazing Joints—A Case History," *ASTM STP 1243, 4<sup>th</sup> Science and Technology of Building Seals, Sealants, Glazing, and Waterproofing*.
  - (9) Schwartz, T.A., Zarghamee, M.S., and Kan, F.W., "Structural Sealant Glazing: In-Service Reliability Evaluation," *ASTM STP 1286, 6<sup>th</sup> Science and Technology of Building Seals, Sealants, Glazing, and Waterproofing*.

8.4 Care should be exercised to ensure that each glass lite is supported fully during the remedial work. Often, it is necessary to stage the remedial work in phases so that the entire perimeter of a lite is not cut out at one time, and to use temporary clips to retain the lites while the new structural sealant cures for the time recommended by the sealant manufacturer.

## 9. Documentation

9.1 It is very important that the remediation data be maintained by the owner in a standardized format. It is recommended that the owner keep all evaluation and remediation reports in one notebook, along with other information pertinent to the SSG installation.

9.2 The remediation report should provide the following information:

9.2.1 Building identification, background information, and references to original design and construction firms.

9.2.2 Purpose of remedy, including triggering event or reason.

9.2.3 Delineation of locations or areas where remedial work was performed.

9.2.4 Products used and test results.

9.2.5 Recommendations for further evaluation or remedial action.

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